

# NASA TECH BRIEF

## *Lewis Research Center*



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### COMPUTER PROGRAM FOR AFTERHEAT TEMPERATURE DISTRIBUTION FOR MOBILE NUCLEAR POWER PLANT

The ESATA computer program has been developed to analyze the thermal safety aspects of post-impacted mobile nuclear power plants. The program calculates the transient temperature and pressure response for a gas-cooled thermal reactor power plant following impact. The analysis is based on a closed containment vessel system with trapped helium gas where the nuclear afterheat must be dissipated by conduction through the containment wall without exceeding the creep-rupture strength of the containment vessel. In addition to the heat transfer mechanisms of conduction, convection, and radiation, phenomena such as core and shield melting and displacement, fission product release from the reactor core followed by subsequent condensation and re-evaporation, metal-water chemical reactions, and pressure buildup due to increased temperatures and volatile products are simulated.

Flexibility was built into the program to consider variable core, shield, and containment vessel dimensions, variable weight, initial temperatures and several shield options. In addition to the problem described, one option of the program permits solution of problems involving transient or steady state heat transfer in multi-dimensional systems having arbitrary geometric configurations, boundary conditions, initial conditions, and physical properties.

#### NOTES:

1. The program is written in FORTRAN IV and designed for the IBM 7094/7044 direct coupled system.
2. The program can be extended to analyze mobile power plant concepts utilizing reactor concepts such as the liquid metal cooled fast reactor. In addition, the program could be extended to perform meltdown analysis of stationary power plants or analysis of post impacted fuel capsules following re-entry.
3. Inquiries concerning this program should be directed to:

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